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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/890,378	01/10/2002	Frank W. Harris	UA 335	1584

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EXAMINER

BISSETT, MELANIE D

ART UNIT	PAPER NUMBER
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1711

DATE MAILED: 03/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/890,378

Applicant(s)

HARRIS ET AL.

Examiner

Melanie D. Bissett

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eb

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5,9-19 and 21-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-5,9-19,21 and 22 is/are allowed.
- 6) ☒ Claim(s) 23-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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1. The rejections based on 35 USC 112 and 102 have been withdrawn based on the applicant's amendments. However, the rejection of claims 23-25 based on 35 USC 103 has been maintained.
2. Note: The examiner wishes to alert the applicant of redundant language in claim 1. The limitation of the insulating layer having a dielectric constant of less than about 2.5 has been added in line 3 and also in the last line of the claim.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hougham et al. in view of Gardner et al.
5. From a prior Office action:

Hougham discloses low dielectric constant polyimides for use on electrical devices such as capacitors, semiconductors, and integrated circuits (abstract; col. 1 lines 26-35). One noted combination of monomers matches the applicant's formulas (I or IV) and III to form a polyimide of 6FDA-PFMB (col. 11 lines 38-58; Table 2). Such a polymer has a dry dielectric constant of 2.71 (Table 3). Because the term *about* 2.7 encompasses values slightly over 2.7 and allowing experimental error, it is the examiner's position that the cited dielectric constant meets the applicant's limitation of *less than about* 2.7.

Further, Hougham teaches dissolving polyamic acids in solvents, including DMAc and NMP, casting and drying a film, heating the film to initiate ring closure and formation of the polyimide, redissolving the film, and cycling the process until a desired molecular weight is achieved (Figure 4; col. 4 lines 13-42). Also, the formation of integrated circuits is mentioned. However, the reference does not specifically indicate casting a dissolved polyimide onto a substrate to form an integrated circuit. Gardner teaches methods for forming an integrated circuit, where the low dielectric materials are deposited or spin-coated onto the substrate (col. 5 lines 44-67). Because Hougham already cycles a process of dissolving a polyimide/polyamic acid, casting the solution onto a substrate, and heating the material to increase molecular weight, it is the

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examiner's position that it would have been prima facie obvious to spin-coat the solution directly onto the integrated circuit substrate to adhere the dielectric material to the substrate from a solution state without additional processing steps. Following the casting procedure of Hougham, the final casting onto an integrated circuit would be heated to further increase molecular weight.

Allowable Subject Matter

6. Claims 1-5, 9-19, and 21-22 are allowed.
7. The closest prior art, Hougham et al. (US 5,324,813 A), discloses low dielectric constant polyimides for use on electrical devices such as capacitors, semiconductors, and integrated circuits. The polyimide materials fit the applicant's formulas (I or IV) and III. However, the reference teaches a dielectric constant for this polymer of 2.71. The reference does not teach forming the polymer to have a dielectric constant of less than about 2.5 or teach the applicant's claimed thermal expansion coefficients. It is therefore the examiner's position that the applicant's claimed dielectric constant of less than about 2.5 and the applicant's claimed thermal expansion coefficients provide a novel and unobvious step over the prior art integrated circuits.

Response to Arguments

8. In response to the applicant's arguments that the Hougham reference does not teach heating the integrated circuit and insulating polyimide layer to a temperature sufficient to evaporate the organic solvent, it is noted that Hougham teaches drying the films and heating the films to temperatures up to 400 °C to imidized or cure the composition (col. 1 lines 26-35; col. 5 lines 43-58; col. 6 lines 21-26; col. 13 lines 3-24). The two main solvents used in the invention, NMP and DMAC, have boiling points of

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202 °C and 166 °C, respectively (Chemfinder.com). Thus, a temperature sufficient to evaporate the solvent would be 202 °C and 166 °C, respectively. Since the films of Hougham's invention are heated to higher temperatures, it is the examiner's position that the reference teaches heating polyimides to temperatures sufficient to evaporate the organic solvent and cure the polyimide. The reference indicates that these temperatures are sufficient to induce curing of the polyimide.

9. Regarding the applicant's arguments that there is insufficient motivation to combine the Hougham and Gardner references due to the conflicting methods of forming film layers, it is first noted that Hougham teaches forming films by coating a substrate with a solution, drying the solution to a film, and heating the film to a temperature for increasing molecular weight (curing). Temperatures cited are as high as 400 °C. Gardner teaches low temperature fabrication of low dielectric films on a substrate to form an integrated circuit. However, the reference defines "high temperature" as 700-900 °C and teaches heating the substrates at temperatures up to 550 °C (col. 7 line 53-col. 8 line 8; col. 10 lines 15-30). Since Gardner teaches that the low dielectric materials are coated directly onto an integrated circuit substrate, it is the examiner's position that it would have been obvious to coat the low dielectric materials of Hougham's invention directly onto an integrated circuit substrate in the final casting step. The examiner has cited that the motivation for such a step would have been to eliminate extra processing steps.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melanie D. Bissett whose telephone number is (571) 272-1068. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Seidleck can be reached on (571) 272-1078. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

James J. Seidleck
Supervisory Patent Examiner
Technology Center 1710

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mdb



James J. Smith
Supervisory Patent Examiner
Technology Center